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STATEMENT OF PURPOSE

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This publication is printed primarily to inform professional range administrators of important range improvement and management developments and findings. These "notes" may include extracts of published work, unpublished reports on administrative studies and personal observations or suggestions of other range administrators. No claim is made as to the accuracy or completeness of studies or conclusions drawn.

All who read these RANGE IMPROVEMENT NOTES are encouraged to submit material for publication, or suggestions for improving its usefulness. Full credit will be given for any material used.

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THE BENMORE EXPERIMENTAL RANGE*

The area. The Benmore Experimental Range, some 3,200 acres in the southeastern corner of Tooele County, lies about 60 miles southwest of Salt Lake City at an elevation of about 5,700 feet. This is spring-fall range, bounded on the north by salt-desert winter range, and on the south by the mountainous summer range of the Sheeprock Mountains. The south end of Rush Valley, where the range is located, is generally level, though broken by shallow, intermittent stream channels.

Its history. The Benmore area was named for two early families, the Bennions and the Skidmores. They and other pioneers in the valley, impressed by the abundance of native grasses, grazed their stock on the range the year around, when snow conditions permitted. In time, as the capacity of the grasses to regenerate was exceeded, grass stands deteriorated, sagebrush increased, and range productivity declined.

Dryfarming. Shortly after 1900, large tracts of sagebrush-grass range were plowed for dryfarming. Fair to good yields of grain were obtained in seasons of average rainfall, but years of low rainfall were too frequent for profitable farming. Although annual precipitation in this century has averaged almost 13 inches, the annual average from 1928 to 1935 was only slightly more than 9 inches - an amount insufficient for dryland grain farming.

Federal purchase. Failure of dryfarming led to the purchase of some 45,000 acres in the midthirties by the National Resources Committee. After purchase, management of the area was entrusted to a succession of government agencies: the Resettlement Administration, the Bureau of Agricultural Economics, the Soil Conservation Service, and in 1954 the Forest Service.

Ranges established. Under Federal management, 3,200 acres of this land were fenced in and designated experimental range. Twenty-eight 100-acre pastures were fenced and seeded to grass, a 280-acre holding pasture was established, and 160 acres were set aside for reseeding studies. Federal agencies also installed a 5,000-gallon tank, two storage reservoirs, pipelines to the pastures, and drilled a well.

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*Maintained by Intermountain Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, in cooperation with Utah State University and the Wasatch National Forest.

Grass seeding. These experimental ranges contain some of the oldest large-scale plantings of crested wheatgrass in the Intermountain West. In the original plantings in 1938 and 1939, fairway or crested wheatgrass was seeded at 2.5 pounds per acre and other grasses were seeded in lesser amounts. Parts of some pastures with poor initial stands were subsequently reseeded at the rate of 4 pounds of crested wheatgrass per acre. The seeded areas were protected from grazing until 1943.

Early Grazing Studies

An early objective of research by the cooperating agencies (U.S. Forest Service, Utah State University, and the Soil Conservation Service) was to compare grazing on seeded range with grazing on the adjacent, depleted range. By 1943, fall grazing was permitted on all pastures; spring grazing was combined with fall grazing on selected pastures from 1944 to 1946 to test yields and grazing capacities. The comparison revealed:

Crested wheatgrass range was ready for grazing about 2 weeks earlier than native range.

About 2.5 acres of crested wheatgrass range would carry a mature cow for 1 month, whereas the same animal would have to graze 12 to 25 acres of depleted sagebrush range per month.

Daily gains on seeded range averaged about 3 pounds per cow, in contrast to gains of about half that amount per cow on depleted range. Moreover, cattle that entered seeded pastures in poor condition in April were usually "grass fat" when they left for summer range in June, but cattle on the native range remained poor.

Increased carrying capacity of the seeded pastures permitted range managers to reduce grazing on adjacent mature brush range. After 15 years of light fall grazing, much of the unseeded native range is now in good condition.

The increased grazing capacity of the spring-fall pastures has enabled range managers to shorten the grazing season on summer range by 2 months.

The uniform breeding season for cattle on seeded range has resulted in a 95-percent calf crop - about 30 percent higher than that for cows on unseeded range, where bulls and cows are run together for the entire grazing season.

Calves from this area command premium prices because they are in top shape at weaning.

Later Studies

Improving methods of grazing. Range managers were interested not only in determining the relative advantages of seeded over unseeded ranges, but also in developing the best methods of grazing improved rangeland. In 1948 they began testing 12 different systems of spring grazing. These studies continued for 11 years and involved twenty-eight 100-acre pastures. (Four pastures were used for holding stock and the other 24 for testing the methods in duplicate.) The 12 methods consisted of combinations of four systems and three intensities of grazing:

1. Rotation. Pastures subdivided into three units, cattle shifted from one unit to another. Each unit grazed twice during the 60-day spring season (April 20-June 20).

2. Continuous. Pastures grazed continuously for the 60-day grazing season (April 20-June 20).

3. Delayed. Beginning of 50-day grazing season delayed 10 days (May 1-June 20).

4. Shortened. Grazing terminated at 50 days (April 20-June 10).

The intensities of grazing were:

1. Light (grass utilization, 53 percent).

2. Moderate (grass utilization, 65 percent).

3. Heavy (grass utilization, 80 percent).

Comparison of grazing intensities. Per-acre gains under heavy grazing were intially high, but dropped below those for moderate grazing after the second year. After 6 years, per-acre gains for heavy grazing declined below those for light grazing. On seeded range at Benmore moderate grazing provided the best long-term production (42.8 pounds per acre for the season, compared to 39.9 and 37.1 pounds for heavy and light grazing, respectively). For best gains and sustained forage production, utilization rates should be between 50 and 60 percent of the available grass.

Heavy grazing produced the lowest daily weight gains for all classes of cattle. Light grazing provided the best daily gains per animal, but because of lighter stocking, produced lower gains per acre than did moderate grazing. Per-acre gains declined under heavy grazing because it was

necessary to reduce the number of grazing animals as forage yields declined.

Comparison of grazing systems. Although the shortened grazing system provided the highest average daily gains for all classes of cattle, the highest gains per acre resulted from either rotation or delayed grazing. (Rotation was superior 7 out of the 11 years of the test.) Average seasonal gains per acre for the 11-year period were: rotation, 42.6 pounds; delayed, 40.6 pounds; continuous, 39.0 pounds; and shortened, 37.3 pounds.

How grazing affected the range. Since these pastures were seeded in the late 1930's, the most striking change over the years has been invasion by big sagebrush and rubber rabbitbrush, which were largely plowed out during the dryfarming period and again when the land was prepared for seeding. Sagebrush tended to increase between 1948 and 1960, but the increase was slight under light and moderate grazing. Heavy grazing (80-percent utilization) led to serious reinvasion of seeded range by sagebrush.

Brush, good and bad. In the Benmore area, sagebrush is harmful to seeded range, but rubber rabbitbrush is not. In fact, researchers have found that yields and quality of grass tend to be better under scattered rabbitbrush than in the open or under sagebrush. The reasons for this difference in effect can be explained by the difference in root systems and growing periods of rabbitbrush and sagebrush. Rabbitbrush has comparatively few lateral roots in the upper soil to compete with grass, whereas big sagebrush roots are highly developed in the surface soils. Further, the growth periods of sagebrush and wheatgrass coincide, whereas most of the growth of rubber rabbitbrush occurs after wheatgrass has matured.

Halogeton. In 1952 this noxious plant was discovered on the Benmore Experimental Range and became an object of study. Researchers found that the growth of halogeton is favored by:

High summer rainfall.

Heavy grazing.

High concentration of soil salts.

Halogeton is more prevalent on ranges heavily grazed in the spring than on moderately or lightly grazed range. On the latter ranges, halogeton is mainly confined to localized heavily grazed spots and to areas with high

concentrations of soil salts. These areas frequently coincide - cattle tend to overgraze areas with high salt concentrations.

Changes in vegetation. One of the beneficial effects of seeding and controlled grazing was the decline of cheatgrass under all intensities of grazing. This decrease was to some extent offset by increases in bulbous bluegrass and low quality herbaceous species.

Fertilization and Grazing Studies

Research at Benmore by Utah State University includes studies of various species of introduced grasses for range seeding, methods of seeding, and range fertilization.

Herbage yields from seeded wheatgrasses. Over the 10-year period from 1953 to 1963, crested wheatgrass produced more forage than any of the other grasses tested on experimental ranges seeded in 1949. However, average yields varied by as much as 500 percent during this period. All the seeded ranges outproduced brushy native range by a wide margin.

Effect of fertilizer on forage yields. Phosphorus and nitrogen fertilizers have been experimentally applied to crested wheatgrass ranges since 1957. Phosphorus did not increase forage yields appreciably, but application of 60 pounds of nitrogen increased yields as much as 1,125 pounds per acre in a favorable year. The average increase in forage yields the first year after application of nitrogen was 598 pounds per acre; "carry-over effect" produced an average increase of 200 pounds of forage the second year after application, but none for the third year. Thus, the average total increase in yield for five separate experiments approximated 800 pounds per acre.

Livestock gains on different species of wheatgrass. All seeded ranges (grazed at light to moderate rates from June 1 to July 15) produced greater livestock gains than did native sagebrush-grass range. Gains for cows and calves tended to be highest on intermediate wheatgrass pastures and lowest on pastures seeded with stiffhair wheatgrass.

Current Grazing Studies

Completion of the 11-year study of spring grazing techniques by no means closed out the research program at Benmore. Many problems in management of wheatgrass range remained to be solved. The U.S. Forest Service and Utah State University have pushed ahead with additional studies of range utilization, including research on the effect of extending the cattle

grazing season, use of sheep to control brush invasion, effects of fertilizing seeded range, and use of additional species of wheatgrass.

Cattle grazing - spring, summer, and fall. Past cattle grazing studies were largely confined to investigation of spring grazing (April through June). Since 1961, cattle have been grazed on some ranges at Benmore from April to December. Some preliminary findings are:

Cows, yearlings, and calves made good gains during spring grazing of seeded ranges.

Gains made by yearlings and calves were reasonably good throughout the summer and early fall; fall and summer gains for cows were low.

Supplemental feeding with soybean meal (3/4 pound per head per day) had little influence on cattle gains in summer but provided increased gains in the fall.

Fall sheep grazing. Studies were begun in 1962 to determine if brush invasion can be controlled by fall sheep grazing. Some preliminary results of these studies are:

Where brush invasion was moderate sheep utilized about 30 percent of big sagebrush and rubber rabbitbrush, but only 5 to 10 percent where brush was heavy.

Utilization of crested wheatgrass averaged 45 percent where brush invasion was moderate, but 65 percent where brush was abundant.

In 1962, when there was little summer rainfall, sheep ate mainly the seedheads of dry grass in the fall. In 1963 sheep preferred green regrowth resulting from summer rains, but also utilized considerable amounts of dry herbage.

Although fall sheep grazing may have improved the range, weight loss in sheep exceeded economical limits. Greatest weight loss occurred on areas with heavy brush. Average poundage lost per sheep during the fall grazing period was:

	1962	1963
Heavy brush	13.4	8.3
Moderate brush	7.4	1.5

RABBIT IMPACT ON RESEEDED GRASS ESTABLISHMENT

By
Ted E. Cox*

The 5-acre Jessie Tie Wash Exclosure was established in 1946 to determine the possibility of reseeding in the sagebrush foothill areas on the western part of the Enterprise Ranger District. The area inside the exclosure was plowed and broadcast seeded with crested wheat. A fair to poor stand of crested wheat was obtained.

In 1962 it was evident that the crested wheat was dying out. Rabbit use was evident on the crested wheat plants and rabbit droppings were numerous inside the exclosure with only few droppings outside.

The following are soil profile characteristics:

0-10" dark brown loam, friable, pH 7.2, contains numerous roots.

10-13" dark brown clay loam, hard when dry, contains few roots.

13-24" brown clay, moderate to strong subangular blocky structure, pH 7.2, very hard when dry, contains very few roots.

The parent material is alluvium.

In April and May 1964 study was initiated to determine rabbit impact on small reseeded and sprayed plots (Figure 1).

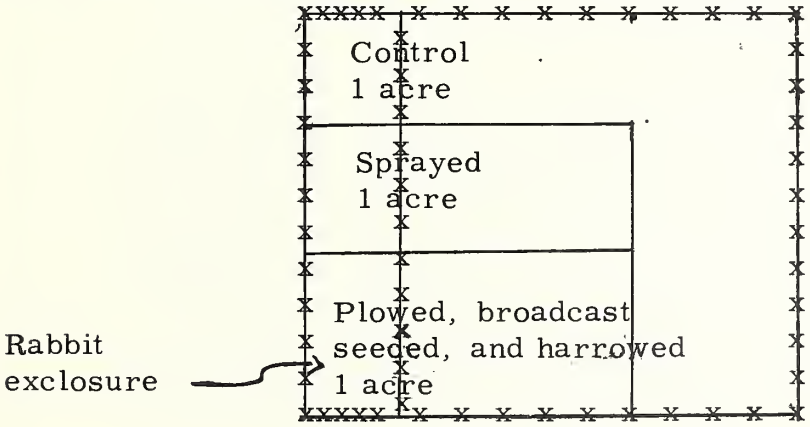

Figure 1 - Study layout

*District Forest Ranger, Dixie National Forest

The rabbits reached their peak population during 1963. Rabbit numbers were at the low point in the spring of 1964.

In August of 1964, there was no live grass seeding outside of the rabbit-tight area except under the protection of the dead sagebrush (Figure 2). There was an average of 2.6 grass seedling per .96 foot inside the rabbit exclosure (Figure 3).

It is too early to determine effects of rabbits or natural response on the sprayed or control plots to date. This information will be available in the future.

Rabbit-tight fence construction design:

> Thirty-six inch high, 1-inch mesh poultry netting was used to exclude the rabbits. Twenty-six inches of the netting were fastened on the posts with approximately 10 inches laid horizontally on the ground surface with the edge stapled to the ground with heavy wire staples placed 4 to 8 feet apart. The top of the netting was fastened to a barbed wire strand with hog nose rings. (Figures 4 and 5.)

Observations to date indicate that this type of construction is just as effective as burying the wire and is cheaper and easier to construct.

Rock, if readily available, could be substituted for the heavy wire staples to hold the netting flat to the ground and would probably be more effective.

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> "Next in importance to the divine profusion of water, light, and air . . . may be reckoned the universal beneficience of grass . . . it invades the solitude of deserts, climbs the inaccessible slopes and forbidding pinnacles of mountains, modifies climates, and determines the history, character, and destiny of nations . . . it yields no fruit in earth or air, and yet should its harvest fail for a single year, famine would depopulate the world."
>
> Senator John J. Ingalls
> 1872

Figure 2 - Closeup view outside rabbit exclosure.

Figure 3 - Closeup view inside rabbit exclosure

Figure 4 - Rabbit-tight fence on existing livestock exclosure.

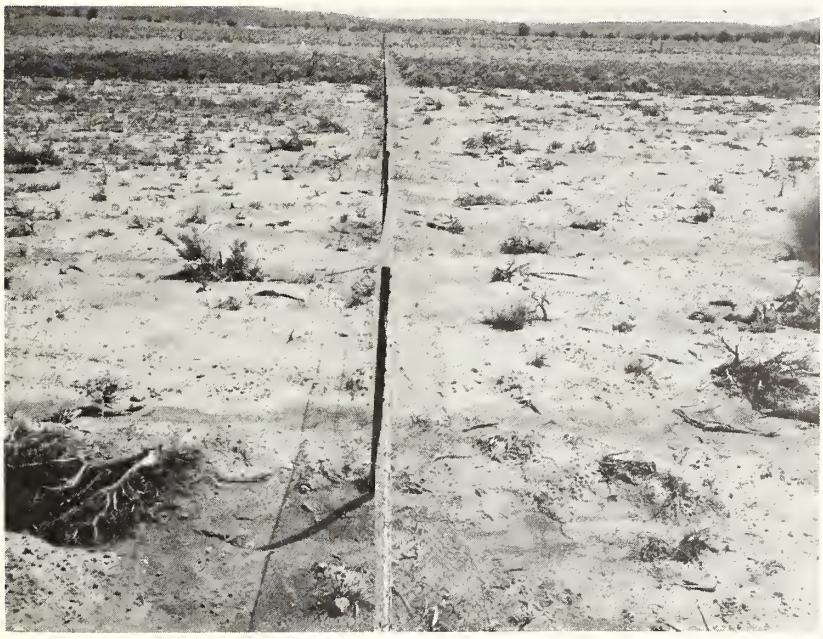

Figure 5 - New rabbit-tight fence inside livestock exclosure.

POISONOUS PLANTS
PRIMARILY HALOGETON*

By
C. Wayne Cook**

Halogeton Poisoning

Halogeton plants contain as much as 28% soluble oxalates during the early fall but the oxalate content may drop as low as 5% in the spring unless the plants are covered with snow during the winter. A cover of snow preserves the oxalates and prevents leaching or loss of leaves and seeds. Seeds average 8.1, leaves 28.1, and stems 3.6% soluble oxalates in the winter grazing season. It was found that small plants contained slightly more oxalates than large plants because they have a greater percentage of leaves.

The soluble oxalates in halogeton are subject to leaching. Both leaching and shattering of seeds affect oxalate content of the plants. Shattering seed tends to increase oxalates in the remaining plant until midwinter; thereafter, leaching tends to decrease the oxalate content. Lethal amounts still remain until mid-April, however.

The consumption of oxalates causes acute hypocalcemia by precipitating the calcium out of the blood and death is believed the result of asphyxia or heart failure brought about by muscular spasms.

Diets under natural grazing may compose as much as 29% halogeton averaging 10.5% soluble oxalates without ill effects. Animals eat more halogeton when they have only an alternate choice of big sagebrush than when halogeton is in association with other range plants or combination of plants. Likewise, as the intensity of grazing increases, consumption of halogeton increases. Animals mainly consume seeds and small plants, avoiding stemmy material unless it supports an abundance of seed.

Forced feeding trials show that it requires as much as 12 ounces of halogeton containing 8.7% soluble oxalates or about 1 ounce of the soluble oxalates to cause death when fed at one time after the

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* From Range and Livestock Management - Cooperative Extension Service - Max C. Fleischmann College of Agriculture, University of Nevada.

**Assistant Dean of the School of Forestry, Range and Wildlife Management, in charge of Research, Range Management Department, Utah State University.

animal has been fasted for 36 hours. However, 18 ounces of the plant or 1.6 ounces of the soluble oxalates will cause death when the animal has a normal fill.

When halogeton was fed with a calcium fortified pellet, as much as 2 pounds of halogeton were consumed at one time without harmful effects and when fed over a period of 12 hours along with a normal fill of range forage, animals consumed as much as 2 1/2 pounds without fatal results. The best pellet tested was composed of 83% alfalfa, 15% calcium carbonate, and 2% molasses.

Attempts to correct the sudden loss of blood calcium by intravenous injections of calcium gluconate at various stages of poisoning have been ineffective. Such treatment merely prolongs the period from feeding until death.

Studies in Utah showed that prolonged feeding of sublethal doses of halogeton or consumption of heavy doses just prior to lambing did not cause abortion and all animals that survived produced lambs at the normal term of gestation.

Halogeton seed retains a high degree of viability even after 5 years of storage at room temperatures. Sheep and rabbits scatter enormous quantities of viable seed great distances by consuming and passing them through their digestive tracts.

Halogeton infested ranges can be grazed without abnormal losses if livestock operators learn to identify the plant and practice good range and livestock management.

Wheatgrass Poisoning

This is sometimes referred to as grass tetany, grass staggers or Hypomagnesaemia. The symptoms are nervousness, unsteady gait, loss of appetite, convulsions, comatose, and death. This is believed to be a result of a lowering of magnesium in the blood.

The levels of various components in the blood serum do not indicate any sure means of identifying the ailment with any particular mineral or component in the blood. Some studies, however, have detected a decrease in the blood magnesium level and others a decrease in blood calcium.

The ailment affects primarily mature females either bred or with young. It may be more rapidly encountered or observed if animals are exercised.

Some suspect that hormonal imbalance of lactating cows vs. dry cows along with nitrate buildup in young growing plants are factors that help precipitate the condition. Others feel that it is not magnesium alone but rather monovalent and divalent imbalance of minerals such as sodium and potassium vs. calcium and magnesium.

Many wheatgrasses when grown on certain soils are capable of storing large quantities of potassium in their tissue (sometimes as high as 5%). The high peak of concentration occurs during the early growth stage in the spring or fall. A slight elevation of potassium in the nerve tissue of animals causes hyperirritability.

It appears that high potassium intake along with high protein intake may lower the absorption of magnesium and likewise increase its elimination in the solid excreta.

The treatment generally prescribed is an intravenous or intraperitoneal injection of 500 cc (sometimes 250 in the vein and 250 under the skin) of 17% calcium gluconate or material used for treatment of milk fever which contains calcium, magnesium, and phosphorous. Remove affected animal from green grass and feed dry hay.

As preventative measures, some feel that mineralized salt, primarily dicalcium phosphate, is beneficial; others recommend dry hay supplements. Still others feel that salt-protein supplements consisting of 20% salt, 10% dicalcium phosphate, and 70% cottonseed oil meal fed free choice is the best preventive measure known. For short periods of time during early growth the dicalcium phosphate could be raised to 12 or 15% and lowered as the wheatgrasses start to head.

It should be mentioned that some researchers feel that supplements of any sort merely prolong the period before the animal will show symptoms. Even if this is true, it might prolong the period long enough for the forage to mature and become less apt to cause wheatgrass poisoning. The research people who theorize that it is an imbalance of monovalent and divalent elements in the diet feel that either water or supplements high in salt (sodium) aggrevates the condition.

From Range and Wildlife Digest

Northern Region

U.S. Forest Service

FENCES AND BIG GAME

The following range fences are recommended for big game. These fence specifications were described by Dick Denny in COLORADO OUTDOORS, March-April 1964.

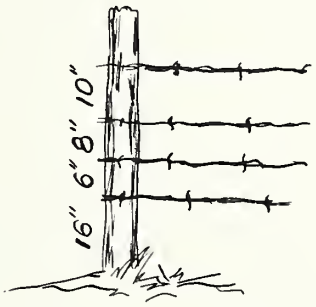

Figure 1

Recommended specifications for barbed wire for cattle and wildlife, Interstate Antelope Committee.

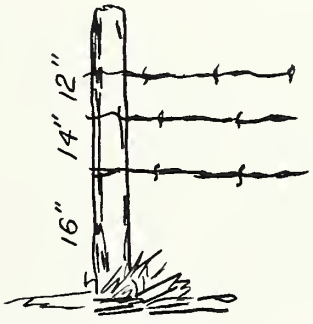

Figure 2

Three-strand barbed wire for cattle.

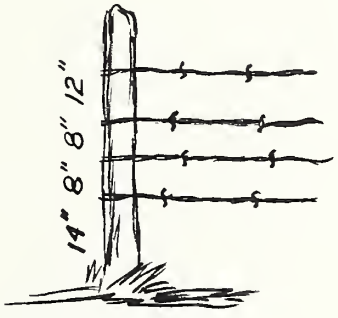

Figure 3

Four-strand barbed wire for cattle.

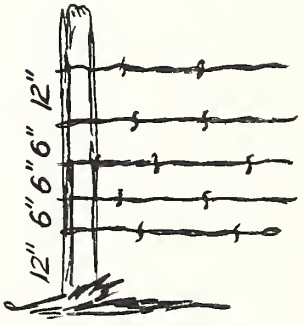

Figure 4

Five-strand barbed wire for cattle.

From Range and Wildlife Digest

Northern Region

U.S. Forest Service

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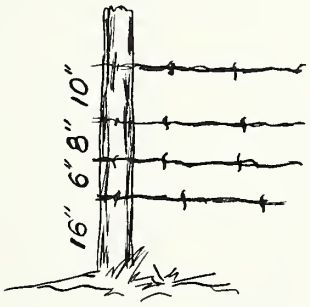

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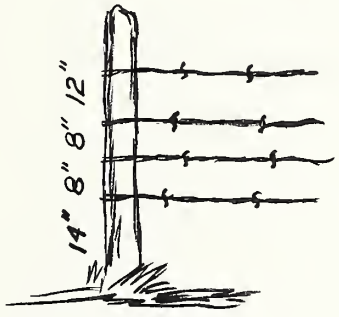

Figure 3

Four-strand barbed wire for cattle.

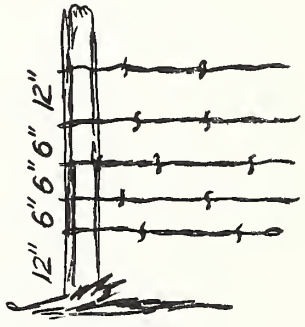

Figure 4

Five-strand barbed wire for cattle.